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26 October 66

MEMORANDUM FOR THE RECORD

SUBJECT : Addendum to 5-10-15 Year Projection for Airborne Reconnaissance Systems.

25X1A REFERENCE: [redacted] 5-10-15 Year Projection for Airborne Reconnaissance Systems, 15 September 1966

25X1A [redacted] Transmittal of 5-15 Year Papers Relating to Quick Reaction Systems and Security Contracting Policies, 7 June 1965

1. This memorandum contains some further considerations on the place of aircraft systems in the National Reconnaissance Program. (Details on aircraft systems which might be available in the time frame considered are given in the references.) Thus, this is an addendum to the fifteen year plan of the references and serves as a rationale for the continuation of aircraft systems as a part of the NRP.

2. The Future Role of Aircraft Reconnaissance Systems in the Agency Collection Inventory:

Aircraft systems ~~rightly~~ have been relegated to a secondary role in the collection of photographic and electronic intelligence. Nonetheless, this secondary role is significant and must be supported. Development and maintenance of this secondary class of systems is necessary because:

a. Aircraft can be defended more easily against attack than satellites and have a high probability of mission success. The merit of this will become apparent only at such time as the existing acquiescence to satellite reconnaissance disappears, either when the posture of the Soviet Union changes, or when some other power (such as Communist China) achieves and uses the capability of denial of satellite reconnaissance. (Current, moderately-sophisticated U.S. and Soviet missile systems have this capability now.) The denial of satellite reconnaissance of China by China would be, concurrently, a denial of all other satellite reconnaissance, including reconnaissance of the Soviet Union. The same satellite overflies the Soviet Union as overflies China; China cannot deny

NRO review(s) completed.

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satellite reconnaissance of China without also denying satellite reconnaissance of the Soviet Union. A similar potential blockage exists regarding other powers, having sophisticated missile capability, if and when the relationships between the U.S. and such powers leads to their denial of U.S. satellite over-flight. The aircraft system is not subject to this restriction, as it can be selectively programmed regarding nations overflown. Advanced aircraft systems could provide a true back-up capability, valid against weapons which exist today, as well as against postulated future capabilities of other nations (presently either friend or foe).

b. Aircraft systems provide a capability of frequent reconnaissance of local areas, a situation approaching the tactical reconnaissance mission of the military; this reconnaissance can be obtained at any part of the world without direct impact on or over-flight of other areas, and the information can be made available to responsible parties in the immediate area. The cost per flight of aircraft systems for such missions is small compared to the cost per flight of the satellite systems, although the original cost of the aircraft system runs much higher than the satellite system. Satellite systems are most economic in the reconnaissance of large areas at reasonably predictable intervals.

c. Flexibility of basing of aircraft systems, and lack of definability of the nation using the systems allows a plausible denial by the U.S. The greatest defect in the plausibility of denial is the sophistication of the aircraft. The characteristics (radar and other) of sophisticated aircraft are such that a firm assignment to the nation of manufacture may be made; the assignment to the nation of operation cannot be so easily made.

d. In many cases, the aircraft systems can provide a more timely flow of information than can the current satellite systems. This timeliness will be less apparent with the oncoming development and operation of satellite systems providing "read-out" from the satellite vehicle to a ground station; this readout capability, however, does suffer from liability to jamming or other interference with the transmission of the data, i.e., a different vulnerability from the current satellite systems, yet a vulnerability. The availability of read-out satellite to field sites, as in "b" above would require a massive ground complex system not currently planned.

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e. It appears from technical considerations that the aircraft systems, working at a more favorable photographic scale factor, can achieve adequate resolution over a wide swath without overtaxing the optical industry of this country.

f. The continuation of the development of high performance reconnaissance vehicles has important technological offshoots. The developments in the OXCART vehicle have had a significant impact on the development of the supersonic transport; similarly, the development of the next generation systems will have an impact on the development of hypersonic military vehicles, (possibly hypersonic civilian vehicles). As the projected advanced aircraft is only a step away from a space vehicle, the technology is of use in the fields of recoverable boosters and space rescue craft. Space rescue craft have received only lip service from the government to date; the first "THRESHER" of space will see the same impact on space rescue that the THRESHER of the ocean gave to deep submersibles and deep ocean rescue. In actuality, the psychological impact of a slow, lingering death in space would be manyfold greater than that from the quick loss in THRESHER.

These ~~six~~ five points constitute the rationale for ~~considering the~~ continuing research of development of advanced aircraft systems portions warranted, and for maintaining existing aircraft capabilities. A reasonable portion of the national photographic and electronic intelligence collection systems budget must be devoted to the ~~development and operation~~ existing and to the of aircraft systems. * This requirement for aircraft systems is valid even though our most advanced existing aircraft system (OXCART) is not actively employed, even for missions wherein it is the (technologically) best system for the task. In conclusion, we would not have the U-2 now extensively used in Vietnam and Cuba, as well as portions of China, if it had not been developed for its early missions in the Soviet Union and subsequently maintained in operational condition since.

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Assistant for Technology
Deputy for
Research and Development
Special Activities

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15 September 66

MEMORANDUM FOR THE RECORD

SUBJECT : 5-10-15 Year Projection for Airborne Reconnaissance Systems

1. Introduction:

With the development of high-altitude aircraft and satellite reconnaissance photography over the past ten years, the intelligence community has come to rely to an increasing extent on the "hard" intelligence derived from such systems. The search is for ever quicker receipt and analysis of the information. Concurrently, the increasing capability of ground to air defensive networks in denied areas forces consideration of less vulnerable systems. In addition to the active defensive networks coming into operation, increased Soviet bloc activity in passive, camouflage defensive techniques is probable. For many technical intelligence requirements there is need for a more detailed rendition of the targets, i.e., high resolution systems. The needs fall naturally into four categories.

a. increased speed of response
b. less vulnerability to active defenses
c. less vulnerability to passive defenses
d. more detailed rendition of targetry

In time of crisis, the first two are of utmost importance. The third item, camouflage penetration, is not critical yet, but will probably become significant within the next ten years. The fourth item, higher resolution, reflects the continuing demand for more technical detail. As any design is a set of compromises, it appears likely that the ultimate needs will be best satisfied by a mix of systems designed for specific tasks. Specifically, there is a real need for continuation of aerodynamic vehicles and balloons as well as satellites -- the aerodynamic for tactical applications and specific targets, and balloons for economic observation of certain types of targets. The impact of the above listed four basic categories of needs on developmen areas, airborne platforms, sensor systems, and data handling is illustrated in Appendix I. The following sections discuss th developmental areas in general details. The timing of expected developments is estimated in Appendix II.

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This paper has been limited to a consideration of airborne systems over the next 15 years. We are well aware that development of orbital systems during this period will be rapid and at times spectacular. A general study of the timing of these developments was made for our own background information in order to place the airborne systems in a more realistic context.

2. Platforms

a. Aerodynamic Vehicles: Following the development of IDEALIST and OXCART manned aircraft, and TAGBOARD drone aircraft, major advancements in aerodynamic vehicles for over-flight purposes can come in two different hypersonic regimes -- first, the boost-glide system such as ISINGLASS, and second, powered flight vehicles, based either on rocket engines or on an air-breathing engine such as the SCRAMJET. These vehicle developments are required in order to reduce the vulnerability of the vehicle to manageable levels by reducing the reaction time available to the defense systems. (An alternate approach to reducing defensive reaction time is the terrain-following, low-altitude, high-speed aircraft. For reconnaissance, these low-altitude aircraft suffer from very limited cross-track coverage and they can be employed only under war-time circumstances. The camera problems associated with the high angular rates inherent in these vehicles are severe, but can probably be managed. We consider this type of aircraft to be limited to the Defense Department for development and use in war-time tactical applications.) 25X1A

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The boost-glide ISINGLASS vehicle using rocket propulsion is feasible in the next five years for application in the following five. Subsequent development may allow longer powered flight or additional range. Air breathing, hypersonic aircraft are a longer range development -- the prime

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need is for validation of the supersonic combustion ramjet (SCRAMJET) engine concept. This concept is promising at this time and is being actively pursued by NASA and the Air Force. However, there has been, to date, no solid demonstration. When available, the SCRAMJET will provide the payload capability for meaningful sustained hypersonic flight. Other advanced propulsion concepts are generally only meaningful in extended orbital or inter-planetary flight. The application of nuclear propulsion may have some significance for the reconnaissance operation, but the nuclear aircraft is not being actively pursued by the government at this time; its eventual application to the reconnaissance mission has not been examined in detail. However, it would appear to have primary benefit for long-term flight in more normal speed-altitude regimes. The extremely high specific impulse rocket engines (plasma, photon, etc.) are generally low thrust and not usable for near earth applications. The

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c. Satellites: Currently satellites are limited in application to quick reaction by several factors:

Count-down time, time from request for data to launch, including mission planning and vehicle preparations.

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Time from launch to coverage of desired targets caused by orbital restraints.

Recovery time and transportation of take.

The high cost of an individual launch and cost of facilities, precluding continued frequent launchings during a crisis period, and also limited economic usefulness for coverage of localized targets. 25X1D

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3. Sensors

Current operational sensors are panchromatic silver halide recording cameras. Resolutions of less than one foot are possible at aircraft altitudes. Developments which can increase angular resolution are conceivable allowing better detail recording or higher altitude operation. However, the most useful developments will probably be in the extension to color recording, adding another dimension to the data. This color recording has several benefits:

a. basic information content increase
b. detection of many types of camouflage, which can "fool" the panchromatic camera
c. application to socio-economic analysis and

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4. Data Handling

A major advance is needed, but coming along rapidly, in the data handling process, particularly in data transmission. In addition, there are a number of other data handling problems that limit overall reaction time. These are in the fields of rapid screening, analysis, storage, and retrieval. Of significance is that the critical analysis is usually a change detection and interpretation of the meaning of the change. The change detection involves a comparison of the current photograph with earlier photographs, hence the need for storage and retrieval. The application of spectral analysis is of interest here. Some mechanization of the change detection would speed up the analysis process considerably, allowing available manpower to concentrate on verifying and interpreting the changes. The analysis problems apparently have much technology in common with data transmission, both handling the information in an electrical or digital analog. Data compression, redundancy reduction techniques, and encoding procedures, useful in transmission bandwidth compression, have promise of allowing mechanization of the change detection operation. We see little hope of the replacement of human judgment in estimating the significance of observed changes.

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Advanced Projects Division
Special Activities

Attachments - 2
As noted above

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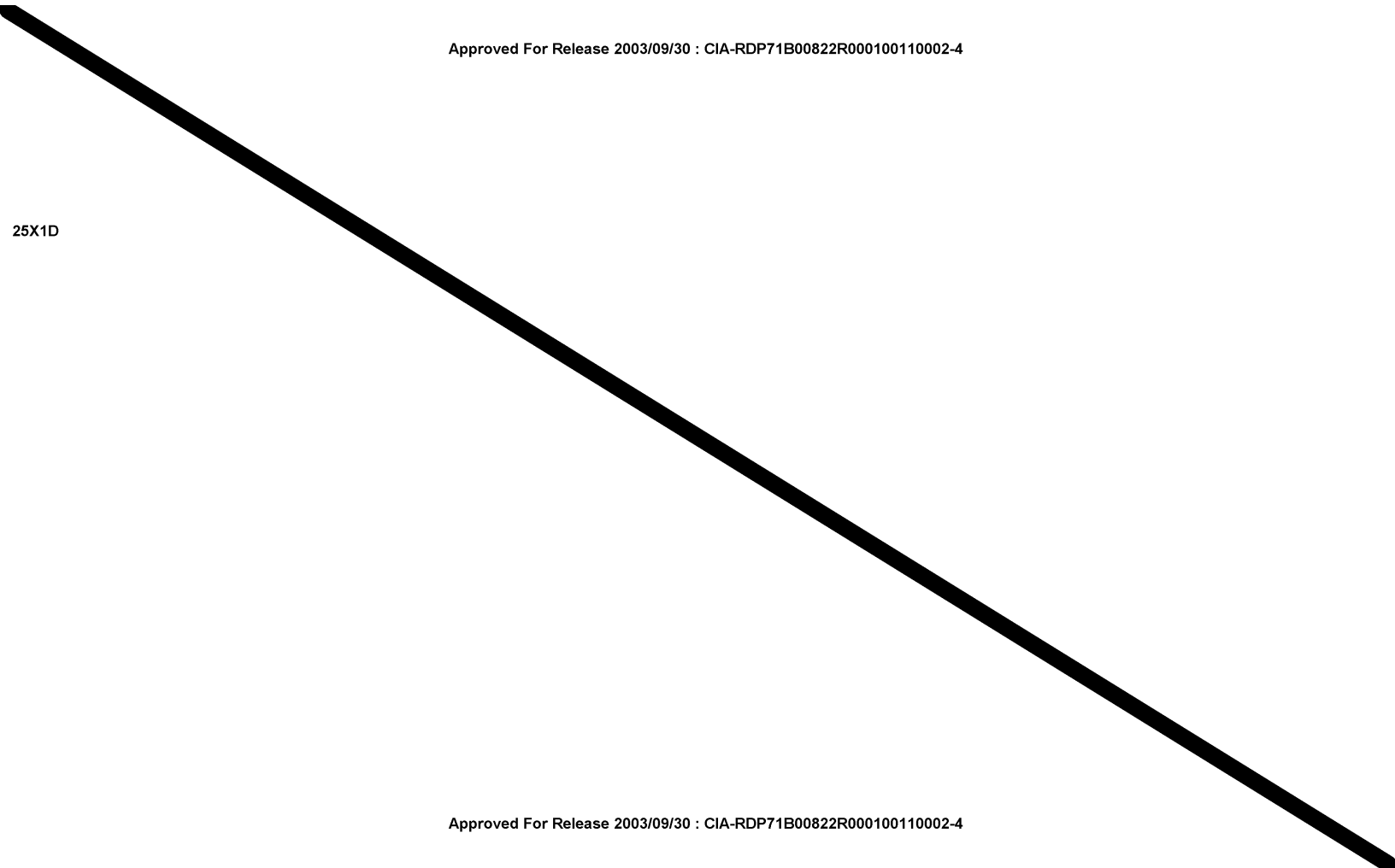

AIRBORNE PLATFORMS

1965 - 70

A. Current Inventory and late development stage:

U-2: Subsonic, high altitude aircraft, 1 ft. photo platform (manned)

OXCART: Mach 3.2 high altitude aircraft, 1 foot photo-platform, requires advanced electronic countermeasures equipment (manned).

SR-71: Advanced version of OXCART, increased payload capability, requires advanced electronic countermeasures equipment (manned).

Drones: Subsonic, high altitude drones in USAF inventory, high vulnerability.

Miscellaneous USAF reconnaissance aircraft, subsonic and limited supersonic.

B. Well into development state:

TAGBOARD: Mach 3.3 drone

C. Early development stage or forecast:

U-2R: Subsonic, high altitude aircraft, 1 ft. photo platform (manned).

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1970 - 75

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DATA HANDLING

1965 - 70

A. Current

Physical transport of films
Human search and analysis

B. Early development and forecast:

Limited, facsimile transmission satellite
Automated storage and retrieval of photographic images
Limited near real-time observation

1970 - 75

Limited automatic screening and change detection
Wide-band facsimile transmission systems
Communications satellites for ground to ground transmission
Simple image integration
Frequent observations and good "baseline" data
Near real time observation

1975 - 80

Spectral analysis
Automation of change detection
Compensation for spaciel frequency response characteristics of sensors and recording media
Secure data links
Continuous monitoring of selected targets

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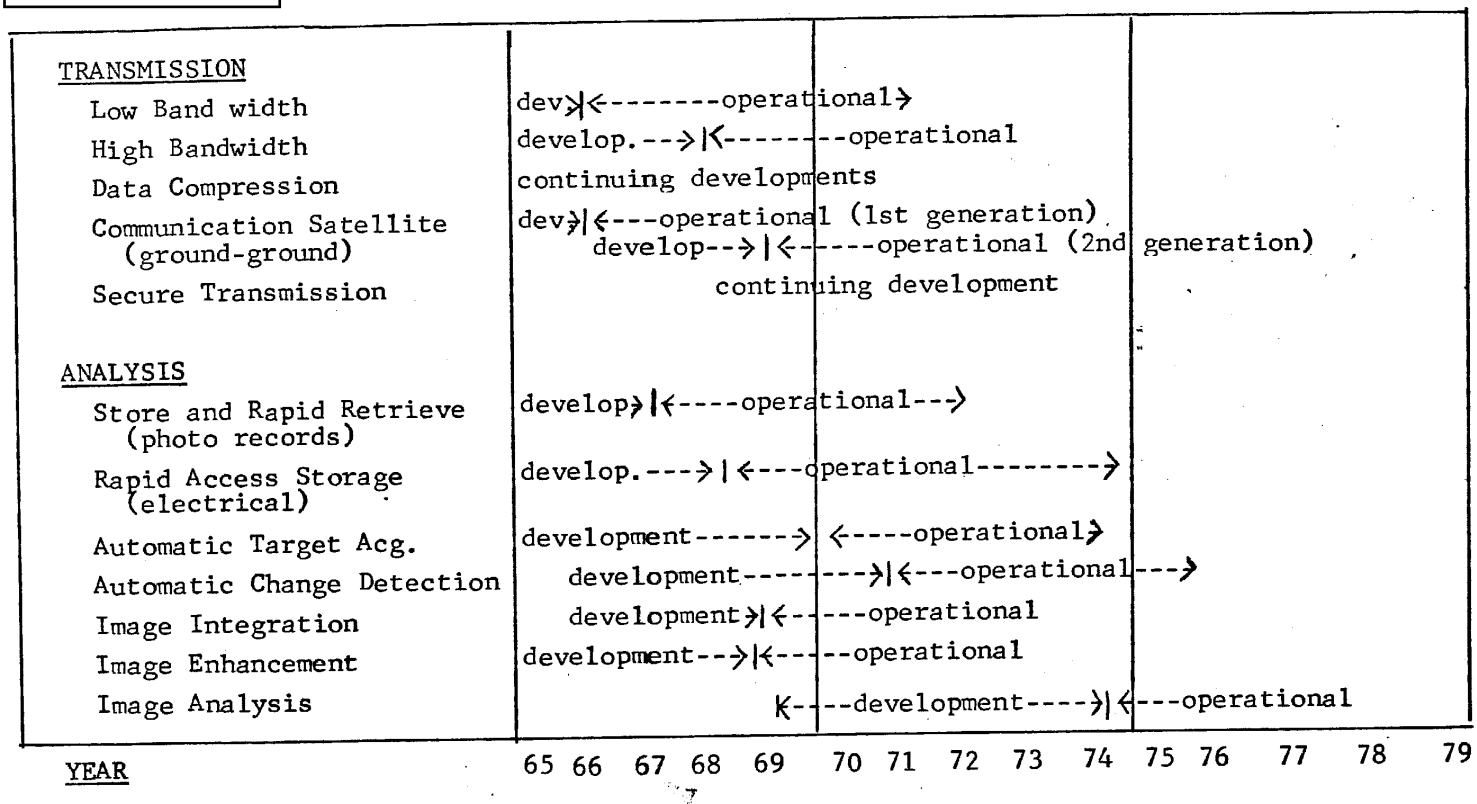

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INTER-RELATIONS OF VARIOUS AERODYNAMIC RECONNAISSANCE VEHICLES

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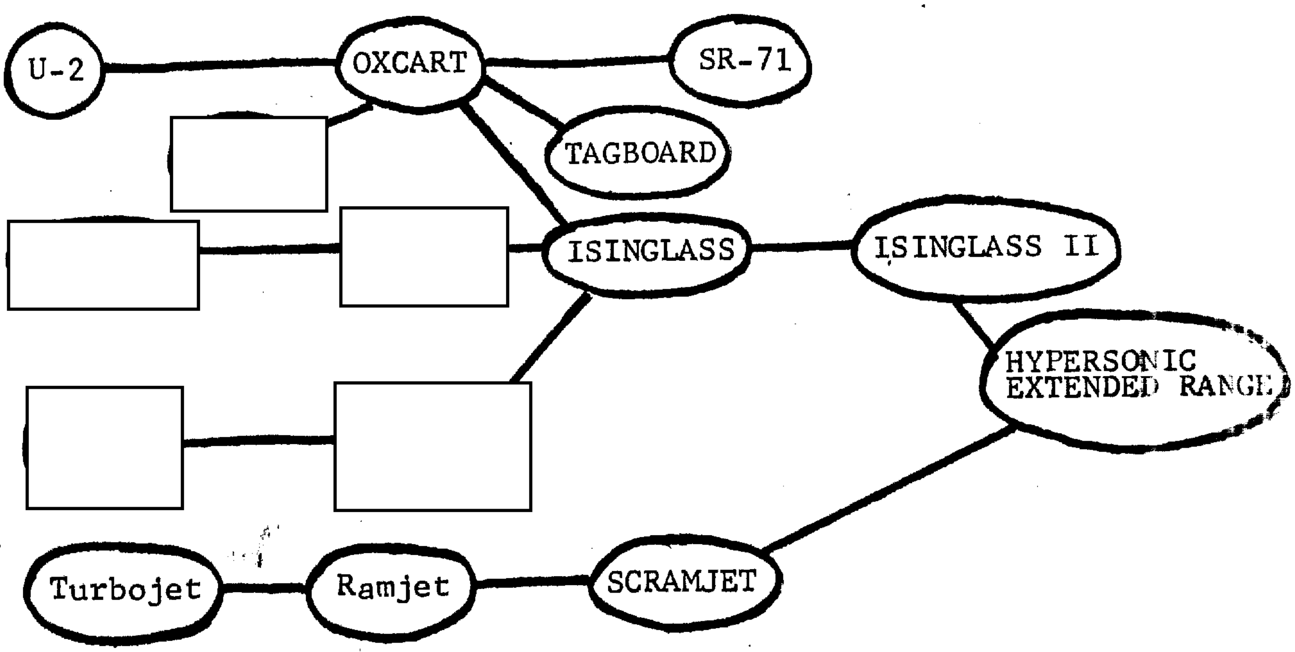

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